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14. ABSTRACT
To evaluate survival of components of a "smart dust sensor" suitable for field deployment after cryoprotection or lyophilization and long term storage. The operational detection system employs molecular motors, particularly kinesins, to move microtubules through a series of chambers.

Particularly, to evaluate the stability of assembled devices (i.e. surface adsorbed kinesin and Ab-MTs) following lyophiliztion.

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FA9550-05-1-0338 FINAL REPORT 2007

ASOSR PROPOSAL NO. 05NL057
MOTOR MOLECULE LONG TERM SURVIVAL IN MOTILITYDEVICES

Dates Covered: 1 May 2005 – 31Oct. 2006

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OBJECTIVES

To evaluate survival of components of a "smart dust sensor" suitable for field deployment after cryoprotection or lyophilization and long term storage. The operational detection system employs molecular motors, particularly kinesins, to move microtubules through a series of chambers.

Particularly, to evaluate the stability of assembled devices (i.e. surface adsorbed kinesin and Ab-MTs) following lyophiliztion

RESULTS

This project formed part of a consortium headed by George Bachand (Sandia Labs), with other participating laboratories: Henry Hess (Univ. FL, Gainesville),B.R.Ratna (Naval Research Lab),Viola Vogel (Swiss Fed. Institute of Technol.)and at AECOM designing and testing a "smart dust sensor" that relies on MT based movement powered by kinesin through a series of chambers of a fabricated flow cell to detect and distinguish biological agents such as smallpox virus or anthrax spores. The strategy was to manufacture the sensors en masse and to seed them over a wide area by air, allowing them to work and retrieving the information from the array of sensors by remote sweep of a laser detector over the seeded area from the air. Our goal was to develop tools for storage of the sensor for reactivation under field conditions. It seems highly likely from our present results that lyophilization will be a successful strategy for storage of the "smart dust sensors" for field deployment, since we have now demonstrated that operational ability of the sensors could be restored by rehydration of the lyophilized chambers after relatively long periods of storage with simple aqueous solution.

We have succeeded in demonstrating that a self-contained MT-kinesin system suitable for miniaturization can be lyophilized, stored for a long period of time, and then rehydrated to restore MT motility. In addition we have shown that derivatized viruses

suitable for use in the smart dust sensor can be similarly lyophilized and stored. A full description of this work is given in the attached publications.

PUBLICATIONS

1. Raviraja N Seetharam, Yuuko Wada, Sujatha Ramachandran, Henry Hess and Peter Satir. 2006. Long-term storage of bionanodevices by freezing and lyophilization. *Lab Chip*, 2006, **6** (9), 1239-1242.

2.Raviraja N Seetharam, Amy Szuchmacher Blum, Charles Guerra, Carissa M. Soto, Jessica L. Whitley, Kim E. Sapsford, Anju Chatterji, John E. Johnson, and Banahalli R. Ratna and Peter Satir (not in sequence). 2007. Long term storage of biotemplated materials for sensing applications. In preparation for Nanotechnology.

PERSONNEL SUPPORTED

Faculty: Peter Satir, Ph. D., Distinguished University Professor (No salary support has been provided)

Postdoctoral Students: Yuuko Wada, Ph.D.
Raviraja Seetharam, Ph.D. (Promoted to Instructor effective July 2006)

Graduate Students: Charles Guerra
Aaron Bell
(No salary support has been provided for graduate students)

PRESENTATIONS

a) Peter Satir, Yuuko Wada and Raviraja Seetharam attended and presented at the DARPA BMM meeting, Feb. 7-8, 2006, Arlington, VA.

b) Peter Satir visited the Max Planck Institute, Dresden, Germany May 17, 2005 . Consultation and discussion with Dr.Joe Howard (Institute Director) re- molecular motors. Dr. Amy Blum (B.Ratna's group, Naval Research Laboratory) visited our laboratory on August 22, 2005 to formulate virus survival experiments after lyophilization. A publication on this work has been submitted to Nanotechnology.